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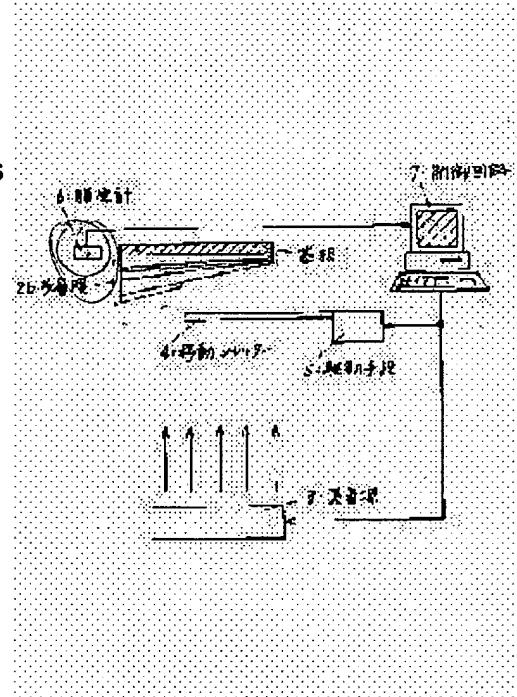
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(54) APPARATUS FOR PRODUCTION OF MULTIWAVELENGTH SELECTIVE OPTICAL FILTER AND MULTIWAVELENGTH SELECTIVE OPTICAL FILTER

(57) Abstract:

PROBLEM TO BE SOLVED: To form a multiwavelength selective optical filter with good accuracy by providing the subject apparatus with a control circuit which controls the thickness of multilayered films formed by controlling a vapor deposition source and moving a shutter driving means in accordance with the output of a film thickness gage.

SOLUTION: A moving shutter 4 is installed between a substrate 1 and a vapor deposition source 8 and is connected to the driving means 5. The film thickness gage 6 is installed near the substrate 1. The film thickness gage 6 measures the thicknesses of the multilayered films 2 successively formed on the substrate 1 and outputs film thickness signals to the control circuit 7. The control circuit 7 controls the evaporation rate of the vapor deposition source 8 in such a manner that a specified film forming rate is attained in accordance with the film thickness signals. The control circuit 7 controls the moving quantity of a driving shutter 4 by controlling the driving means 5 in such a manner that the film thickness previously determined by simulation, etc., in accordance with the film thickness signals is attained. As a result, the multiwavelength selective optical filter of which the transmission characteristics are changed in an x-axis direction (one dimensionally) is produced.



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【特許請求の範囲】

【請求項1】一枚で多波長の波長選択が可能な光学フィルタの製造装置において、蒸着源と、基板に形成される多層膜の膜厚を測定する膜厚計と、前記蒸着源と前記基板との間に設けられた移動シャッターと、この移動シャッターを駆動する駆動手段と、前記膜厚計の出力に基づき前記蒸着源及び前記駆動手段を制御して形成される前記多層膜の膜厚を制御する制御回路とを備えたことを特徴とする多波長選択光学フィルタの製造装置。

【請求項2】1次元方向に膜厚が分布した多波長選択光学フィルタを膜厚が2次元方向に分布するように一定角度で切断したことを特徴とする多波長選択光学フィルタ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は分光測定等に用いられる光学フィルタの製造装置に関し、特に一枚で多波長の波長選択が可能な多波長選択光学フィルタの製造装置及び多波長選択光学フィルタに関する。

【0002】

【従来の技術】従来の光学フィルタは基板上に多層膜を積層することにより構成されていた。図4はこのような従来の光学フィルタの一例を示す断面図及び特性曲線図である。

【0003】図4(A)において1は基板、2は多層膜である。基板1に蒸着等により多層膜2を形成することにより光学フィルタが製造される。このような光学フィルタは図4(B)に示すように"イ"に示す特定波長のみの光が透過する特性を有している。

【0004】

【発明が解決しようとする課題】しかし、分光測定等で前述のような光学フィルタを用いる場合には、複数波長の光を必要とするため、前記複数の波長に対応した透過特性を有する光学フィルタを多数用意する必要がある。

【0005】また、光学フィルタの透過波長を安定化させるためには光学フィルタの温度制御が必須であるが、前述のように多数の光学フィルタを均一に温度制御することは困難であると言った問題点がある。

【0006】この問題点を解決する方法としては一枚の光学フィルタに複数の透過特性を持たせた多波長選択光学フィルタが考えられる。図5はこのような従来の多波長選択光学フィルタ製造方法の一例を示す説明図である。

【0007】図5において1は基板、2aは多層膜、3は蒸着源である。この製造方法は蒸着源3からの距離等により蒸着量が変化することを応用したものであり、多層膜2a"イ"の部分は蒸着源3に近いので多層膜"

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"の部分と比較して膜厚が厚くなる。

【0008】この結果、多層膜2a"イ"の部分と多層膜2a"ロ"の部分とでは透過する波長が異なることになり、多層膜2a"イ"の部分から多層膜2a"ロ"の部分にかけて透過する波長が変化することになる。

【0009】但し、蒸着源3からの距離等により透過波長分布を制御する場合には前記透過波長分布を精度良く制御することは困難であると言った問題点がある。従つて本発明が解決しようとする課題は、精度良く多波長選択光学フィルタを形成することが可能な多波長選択光学フィルタの製造装置を実現することにある。

【0010】

【課題を解決するための手段】このような課題を達成するため、本発明の第1では、一枚で多波長の波長選択が可能な光学フィルタの製造装置において、蒸着源と、基板に形成される多層膜の膜厚を測定する膜厚計と、前記蒸着源と前記基板との間に設けられた移動シャッターと、この移動シャッターを駆動する駆動手段と、前記膜厚計の出力に基づき前記蒸着源及び前記駆動手段を制御して形成される前記多層膜の膜厚を制御する制御回路とを備えたことを特徴とするものである。

【0011】本発明の第2では、1次元方向に膜厚が分布した多波長選択光学フィルタを膜厚が2次元方向に分布するように一定角度で切断したことを特徴とするものである。

【発明の実施の形態】以下本発明を図面を用いて詳細に説明する。図1は本発明に係る多波長選択光学フィルタの製造装置の一実施例を示す構成ブロック図である。

【0012】図1において1は基板、2bは多層膜、4は移動シャッター、5は駆動手段、6は膜厚計、7は制御回路、8は蒸着源である。

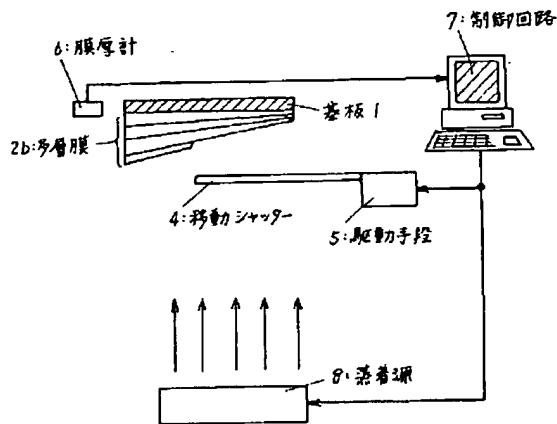
【0013】移動シャッター4は基板1と蒸着源8との間に設置されると共に駆動手段5に接続され、膜厚計6は基板1の近傍に設置される。膜厚計6の出力は制御回路7に接続され、制御回路7からの制御信号は駆動手段5及び蒸着源8に接続される。

【0014】ここで、図1に示す実施例の動作を図2及び図3を用いて説明する。図2は移動シャッター4の形状例を示す平面図であり、図2(A)は1軸方向に平行移動するもの、図2(B)は"イ"を中心に回転運動するものである。また、図3は図1に示す実施例で製造される多波長選択光学フィルタの一例を示す平面図である。

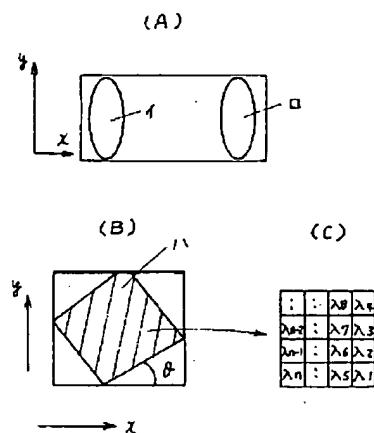
【0015】説明に際しては簡単のため図2(A)の移動シャッターを用いて説明する。膜厚計6は基板1に順次形成される多層膜2bの膜厚を測定し、多層膜2bの膜厚信号を制御回路7に出力する。

【0016】波長"λ1"～"λn"までの透過分布を有する多波長選択光学フィルタを製造する場合にはシミュレーション等により各波長を透過する多層膜2bの膜

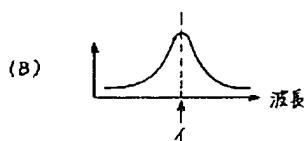
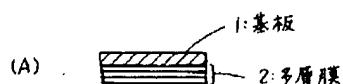
【図1】



【図3】



【図4】



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CLAIMS

[Claim(s)]

[Claim 1] In the manufacturing installation of the light filter in which the wavelength selection of many wavelength is possible at one sheet The migration shutter prepared between the source of vacuum evaporationo, the thickness gage which measures the thickness of the multilayers formed in a substrate, and said source of vacuum evaporationo and said substrate, The manufacturing installation of the multi-wavelength selection light filter characterized by having the driving means which drives this migration shutter, and the control circuit which controls the thickness of said multilayers which control said source of vacuum evaporationo and said driving means, and are formed based on the output of said thickness gage.

[Claim 2] The multi-wavelength selection light filter characterized by cutting the multi-wavelength selection light filter with which thickness was distributed in the direction of one dimension at a fixed include angle so that thickness may be distributed in the two-dimensional direction.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] This invention relates to the manufacturing installation of the multi-wavelength selection light filter in which the wavelength selection of many wavelength is possible, and a multi-wavelength selection light filter by one sheet especially about the manufacturing installation of the light filter used for spectrometry etc.

[0002]

[Description of the Prior Art] The conventional light filter was constituted by carrying out the laminating of the multilayers on a substrate. Drawing 4 is the sectional view and characteristic curve sheet showing an example of such a conventional light filter.

[0003] In drawing 4 (A), 1 is a substrate and 2 is multilayers. A light filter is manufactured by forming multilayers 2 in a substrate 1 by vacuum evaporationo etc. Such a light filter has the property which the light of only the specific wavelength shown in "I" as shown in drawing 4 (B) penetrates.

[0004]

[Problem(s) to be Solved by the Invention] However, since it needs two or more waves of light in using the above light filters by spectrometry etc., it is necessary to prepare many light filters which have a transparency property corresponding to said two or more wavelength.

[0005] Moreover, although the temperature control of a light filter is indispensable in order to stabilize the transmitted wave length of a light filter, there is a trouble said that it is difficult to carry out temperature control of many light filters to homogeneity as mentioned above.

[0006] The multi-wavelength selection light filter which gave two or more transparency properties to the light filter of one sheet as an approach of solving this trouble can be considered. Drawing 5 is the explanatory view showing an example of such a conventional multi-wavelength selection light filter manufacture approach.

[0007] As for a substrate and 2a, in drawing 5 , 1 is [multilayers and 3] the sources of vacuum evaporationo. As for this manufacture approach, it applies that the amount of vacuum evaporationo changes with the distance from the source 3 of vacuum evaporationo etc., and since the part of multilayers 2a "I" is close to the source 3 of vacuum evaporationo, as compared with the part of multilayers "RO", thickness becomes thick.

[0008] consequently -- multilayers -- two -- a -- " -- I -- " -- a part -- multilayers -- two -- a -- " -- RO -- " -- a part -- penetrating -- wavelength -- differing -- ***** -- multilayers -- two -- a -- " -- I -- " -- a part -- from -- multilayers -- two -- a -- " -- RO -- " -- a part -- applying -- penetrating -- wavelength -- changing -- *****

[0009] However, in controlling transmitted wave length distribution by distance from the source 3 of vacuum evaporationo etc., there is a trouble said that it is difficult to control said transmitted wave length distribution with a sufficient precision. Therefore, the technical problem which this invention tends to solve is to realize the manufacturing installation of the multi-wavelength selection light filter which can form a multi-wavelength selection light filter with a sufficient precision.

[0010]

[Means for Solving the Problem] In order to attain such a technical problem, in the 1st of this invention In the manufacturing installation of the light filter in which the wavelength selection of many wavelength is possible at one sheet The migration shutter prepared between the source of vacuum evaporationo, the thickness gage which measures the thickness of the multilayers formed in a substrate, and said source of vacuum evaporationo and said substrate, It is characterized by having the driving means which drives this migration shutter, and the control circuit which controls the thickness of said multilayers which control said source of vacuum evaporationo and said driving means, and are formed based on the output of said thickness gage.

[0011] In the 2nd of this invention, it is characterized by cutting the multi-wavelength selection light filter with which thickness was distributed in the direction of one dimension at a fixed include angle so that thickness may be distributed in the two-dimensional direction.

[Embodiment of the Invention] This invention is explained to a detail using a drawing below. Drawing 1 is the configuration block Fig. showing one example of the manufacturing installation of the multi-wavelength selection light filter concerning this invention.

[0012] drawing 1 -- setting -- 1 -- for a migration shutter and 5, as for a thickness gage and 7, a driving means and 6 are [a substrate and 2b / multilayers and 4 / a control circuit and 8] the sources of vacuum evaporationo.

[0013] The migration shutter 4 is connected to a driving means 5 while it is installed between a substrate 1 and the source 8 of vacuum evaporationo, and a thickness gage 6 is installed near the substrate 1. The output of a thickness gage 6 is connected to a control circuit 7, and the control signal from a control circuit 7 is connected to a driving means 5 and the source 8 of vacuum evaporationo.

[0014] Here, actuation of the example shown in drawing 1 is explained using drawing 2 and drawing 3. Drawing 2 is the top view showing the example of a configuration of the migration shutter 4, and drawing 2 (A) rotates the thing and drawing 2 (B) which carry out a parallel displacement to 1 shaft orientations focusing on "I." Moreover, drawing 3 is the top view showing an example of the multi-wavelength selection light filter manufactured in the example shown in drawing 1.

[0015] On the occasion of explanation, since it is easy, it explains using the migration shutter of drawing 2 (A). A thickness gage 6 measures the thickness of multilayers 2b by which sequential formation is carried out to a substrate 1, and outputs the thickness signal of multilayers 2b to a control circuit 7.

[0016] wavelength -- in manufacturing the multi-wavelength selection light filter which has the transparency distribution to "lambda1"- "lambdaN", it asks for the thickness of multilayers 2b which penetrates each wavelength by simulation etc. beforehand.

[0017] A control circuit 7 controls the evaporation of the source 8 of vacuum evaporationo so that a membrane formation rate becomes fixed based on said thickness signal.

[0018] Moreover, to become the thickness for which it asked by simulation etc. previously based on said thickness signal, a control circuit 7 controls a driving means 5, and controls the movement magnitude of the migration shutter 4.

[0019] generally, the design of a single wavelength selection light filter is indicated in reference, such as an "optical thin film", -- having -- **** -- for example, a SHW mold (Single Half-Wave System) -- setting -- wavelength -- in order to give the transparency property of "lambdaN" -- substrate /HnLnHnLn2HnLnHnLnHn/ -- air -- it is made a configuration.

[0020] Here, "Hn" is the optical thickness of the high refractive-index matter, "Ln" is the optical thickness of the low refractive-index matter, and "m" and when thickness is set to "d", the relation between $Hn = \lambda n / 4 = m - d$ is shown for a refractive index.

[0021] After the above-mentioned configuration's forming the high refractive-index matter of thickness "Hn", and the low refractive-index matter of thickness "Ln" twice one by one on a substrate 1 and forming the high refractive-index matter of thickness "2Hn", forming twice one by one further with the low refractive-index matter of thickness "Ln" and the high refractive-index matter of thickness "Hn" is shown.

[0022] therefore, the control circuit 7 -- said thickness signal -- being based -- a driving means 5 --

controlling -- the movement magnitude of the migration shutter 4 -- controlling -- transmitted wave length -- the film of the high refractive-index matter corresponding to "lambda1"- "lambdaN" and the low refractive-index matter is formed, respectively.

[0023] consequently, the thing for which the thickness of multilayers 2b formed in a substrate 1 is controlled by the migration shutter 4 -- drawing 3 (A) -- the field which "lambdaN" shown in "I" penetrates forms -- having -- drawing 4 (A) -- the multi-wavelength selection light filter from which a transparency property changes in the direction of a x axis (one dimension) to the field which "lambda 1" shown in "RO" penetrates can be manufactured.

[0024] Since the movement magnitude of said migration shutter 4 is controlled carrying out the monitor of the thickness of multilayers 2b by the thickness gage 6, it becomes possible to form a multi-wavelength selection light filter with a sufficient precision.

[0025] Moreover, the multi-wavelength selection light filter from which a transparency property changes in x and the direction of the y-axis (two-dimensional) as shown in drawing 3 (C) is realizable by cutting like "Ha" at an include angle theta to a x axis, as shown in drawing 3 (B). Here, an include angle theta is about 11 degrees.

[0026] Furthermore, by manufacturing the wavelength selection light filter of one sheet which penetrates many wavelength, in using for spectrometry etc., temperature control becomes easy and a miniaturization also becomes possible.

[0027] In addition, although the example shown in drawing 1 explained using the migration shutter of the configuration shown in drawing 2 (A), by the migration shutter of the configuration shown in drawing 2 (B), it is easy to be natural and especially the configuration of a migration shutter is not limited, either.

[0028] Moreover, although multilayers 2b is formed by moving the migration shutter 4 several times in explanation of the example shown in drawing 1, the source 8 of vacuum evaporation may be controlled and multilayers 2b may be formed by one migration of the migration shutter 4. What is necessary is just to choose this suitably by relation with a vacuum evaporation rate.

[0029]

[Effect of the Invention] According to this invention, there is the following effectiveness so that clearly from having explained above. The manufacturing installation of the multi-wavelength selection light filter which can form a multi-wavelength selection light filter with a sufficient precision is realizable from controlling the thickness of the multilayers formed in a substrate by the migration shutter.

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